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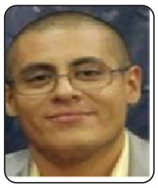
Abstract



Case Study: Energy-Management System for a Grid-Connected Residential DC Microgrid

Víctor Manuel Sámano Ortega

[1]*Tecnológico Nacional de México en Celaya, Doctorado en Ciencias de la Ingeniería, Celaya Gto. México*

Abstract:

Power consumption increase and the never-ending industrial demand on electrical energy haveresulted in a depletionof conventional generation resources, such as fossil fuels.On the other hand, renewable energiesare still facing issues for massive generation and supply due to its unpredictable nature.One alternative to solve these issues isthe distributed generation techniques sourced by renewable energy which require efficient and highlyreliable power management schemes in microgrids.

Among the investigations carried out on energymanagement systems (EMSs) in microgrids(μGs) there are different approaches that includes scheduling strategies, cost reduction or energy commercialization, among others. However, in author's opinion, some of themare oversimplified and other considers ideal conditions, which are not satisfied in real-life situations.Therefore, the design and implementation of anEMS applied to aresidential direct current microgrid (DC-μG) is presented in this work. The proposed residentialDC-μG is designed to provide a maximum power of 1 kW by using two photovoltaic arrays(PAs) of 500 W, a battery bank (BB) of 120 V–115 Ah, a supercapacitor module of 0.230 F and abidirectional DC–AC converter linked to the AC main grid (MG). The EMS works as a centralized

manager and it defines the working operation mode for each section of the DC-μG. The operationmodes are based on: (1) the DC-link bus voltage, (2) the generated or demanded power to eachsection of the DC-μG and (3) the BB's state of charge. The proposed EMS—during the several workingoperation modes and at the same time—can obtain the maximum energy from the PAs, reducethe energy consumption from the main grid and keep the DC-link bus voltage inside a range of190 V ± 5%. The EMS and local controllers are implemented by using LabVIEW and NI myRIO-1900platforms. Moreover, experimental results during connection and disconnection of

each DC-μGsections and different on-the-fly transitions are reported, these results focus on the behavior of the DCbus, which shows the DC bus robustness and stability underdifferent scenarios.

Biography:

Juan Jose Martinez Nolasco received his B.S. degree in Electronics Engineering from theTechnological Institute of Guzman City, Jalisco, Mexico, in 2007; M.S. degree in Electronics Engineering from the Technological Institute of Celaya, Guanajuato, Mexico, in 2009; and a Ph.D. in Engineering Science from the Technological Institute of Celaya, Guanajuato, Mexico, in 2018. He is currently teacher and researcher in the Department of Mechatronics Engineering, Technological Institute of Celaya, his research interests include Intelligent Control, Direct Current Microgrids and Applications of Fuzzy Logic Control.

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